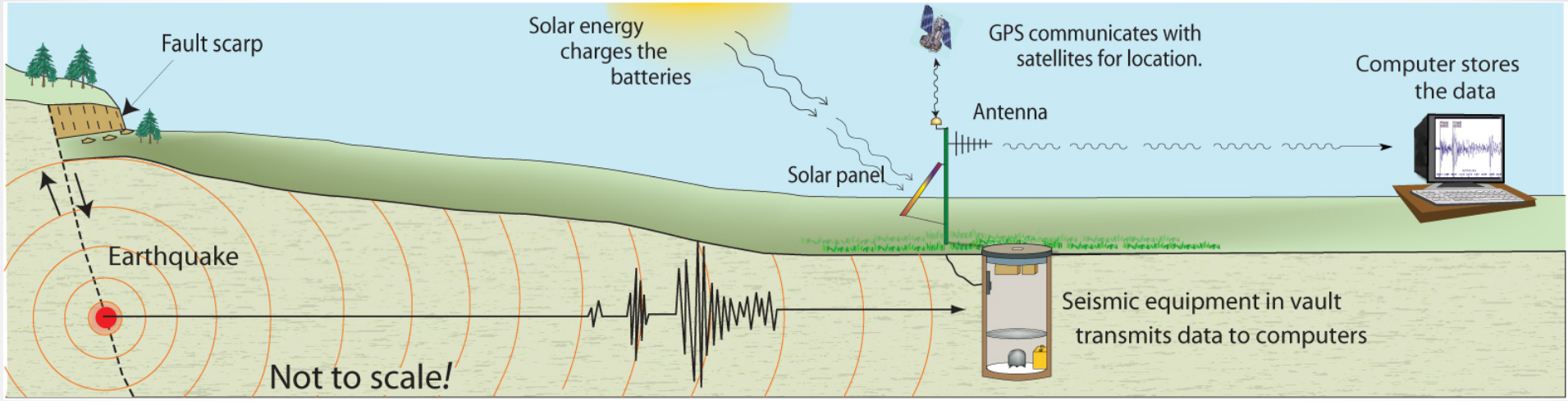
The Use of Seismological Data in Research and Hazard Applications

Katrin Hafner
IRIS GSN Program Manager
June 22, 2016

ADVANCES in EARTH SCIENCE BRIEFING SERIES

Typical Seismic Station

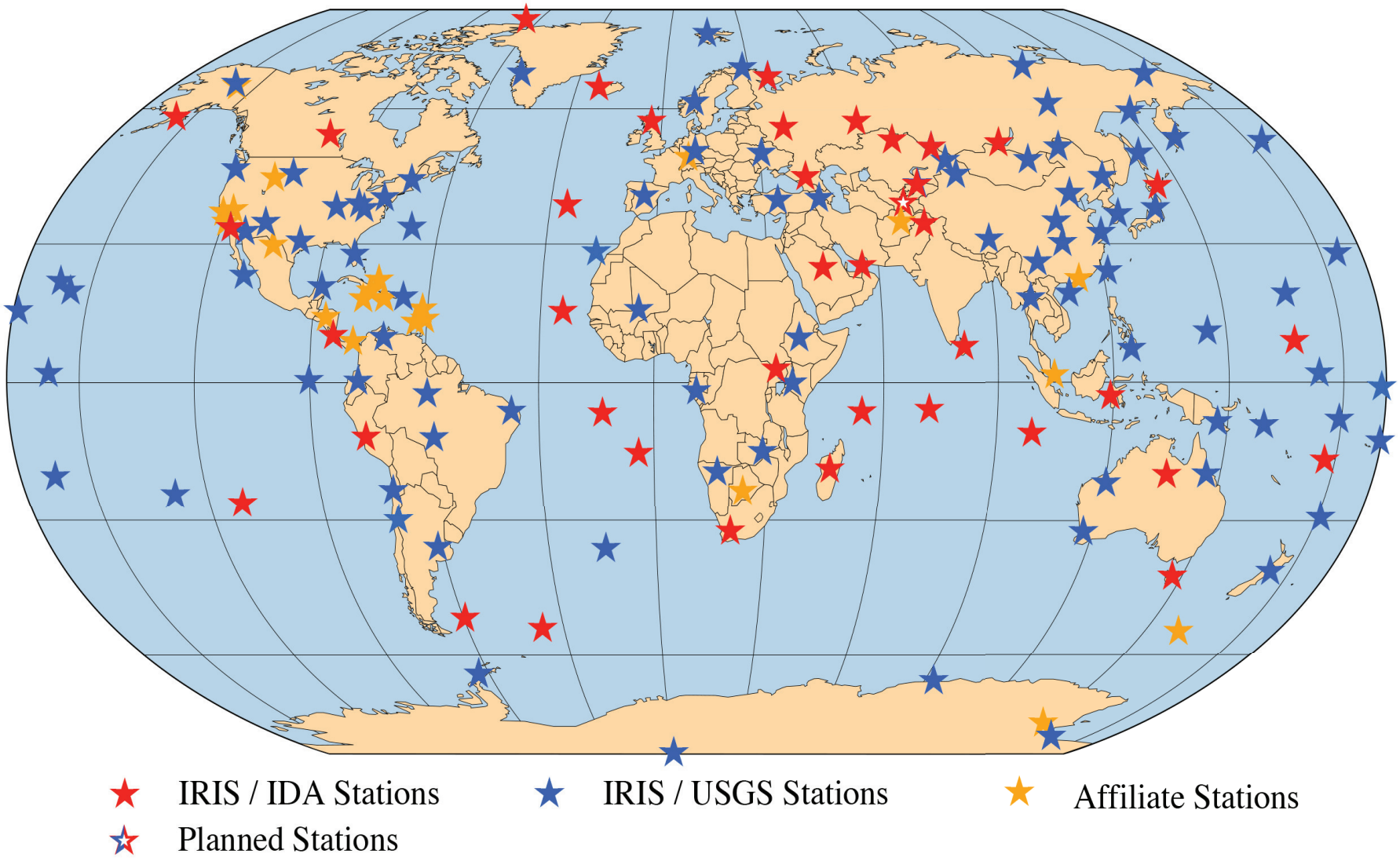




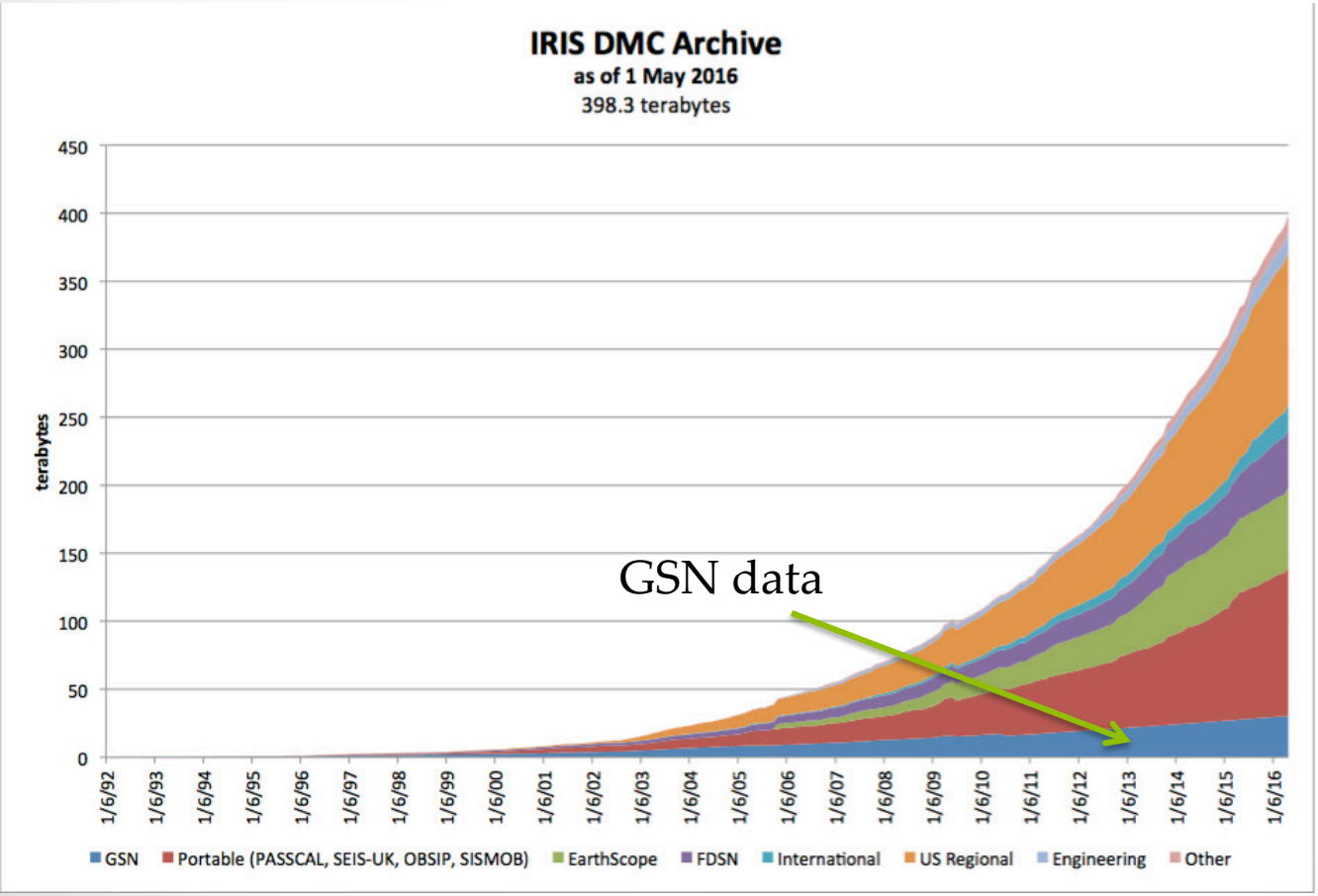




Global Seismographic Network (GSN)



IRIS Data Archive



1992

2016

Archives data from over 1000 seismic networks

Size of data archive: 400 Tb and growing exponentially

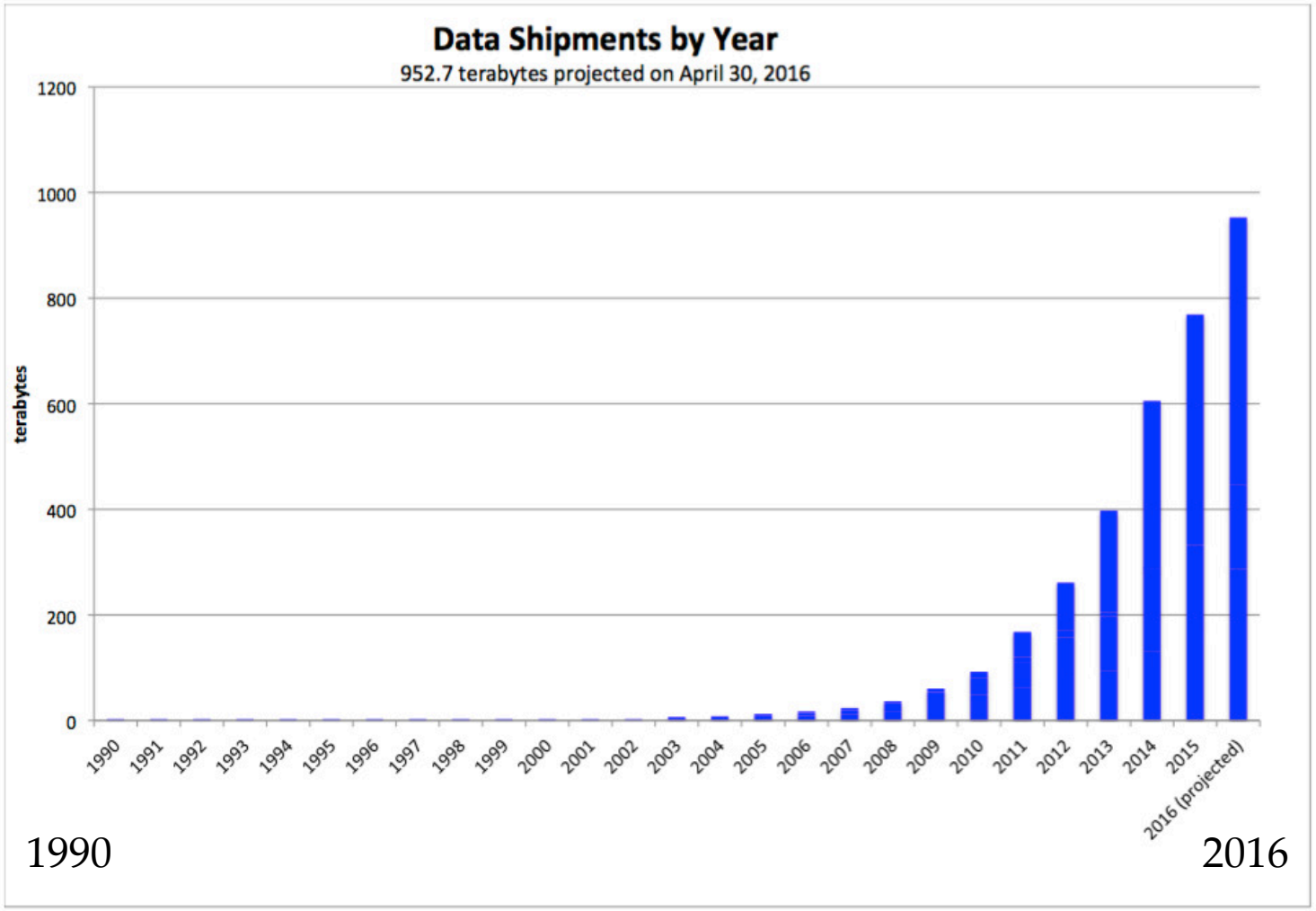
DMC receives ~192 Gb of real-time data/day

IRIS Data Distribution

In 2016, DMC expects to distribute ~1 Pb (1000 Tb) of data to users

DMC distributes data to over 19,000 unique users in 173 countries around the world

All data are free and openly available



GSN Partnerships

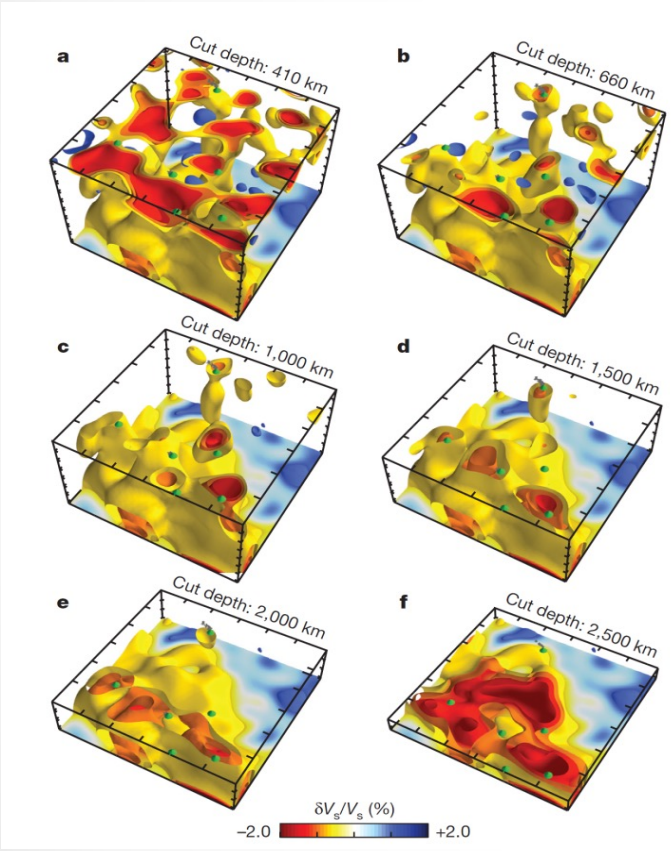
- GSN is a partnership – NSF, USGS & IRIS
  - ✧ Other US government contributions have bolstered support and reinvestment in the GSN for its multi-use capabilities

    Dept of Defense *Dept of Energy* *Dept of State*

- Host country partnerships
  - ✧ MOUs between foreign governments, private entities & universities
  - ✧ Long-standing relationships between network operators and local personnel

- National Organizations
  - ✧ NOAA, NEIC, PTWC, NTWC – assist with data flow & delivery

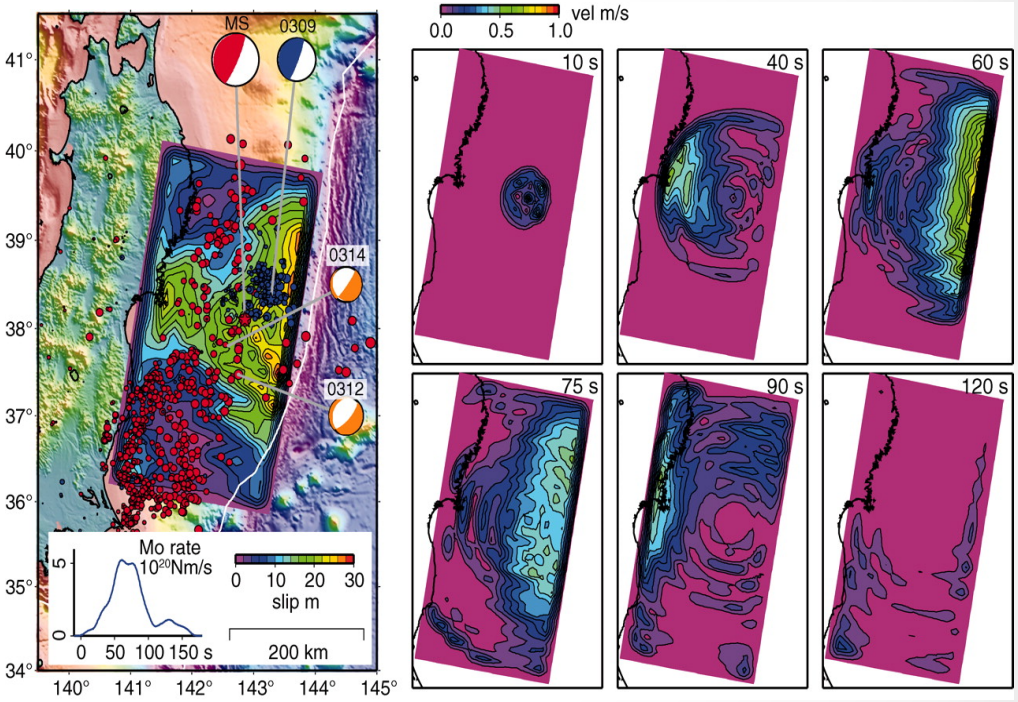
Global Earth Structure



French & Romanowicz Nature 2015

Three-dimensional shear-wave-velocity Structure in the Pacific Region

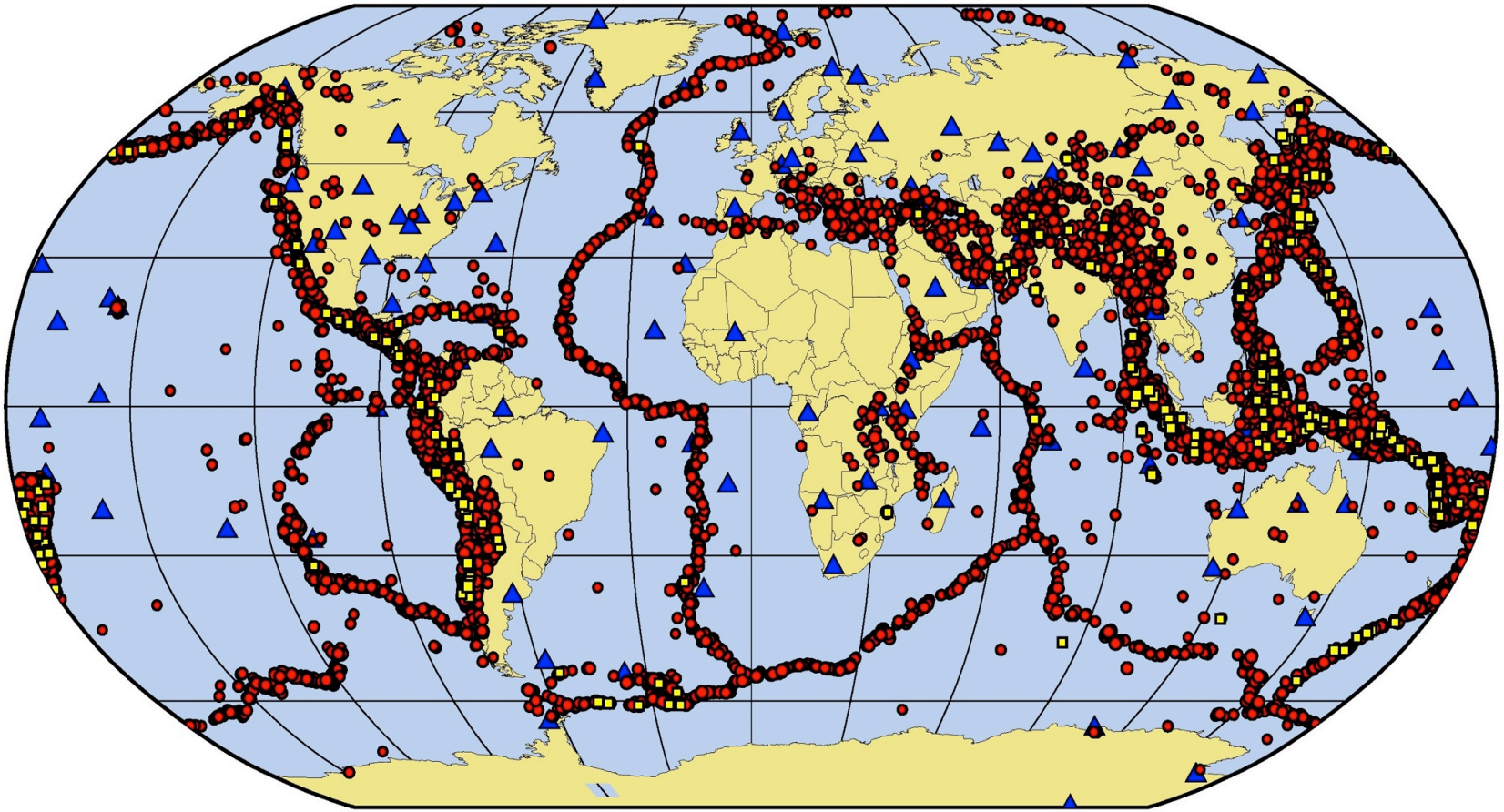
Understanding Great Earthquakes



Ide, Baltay & Beroza – Science 2011

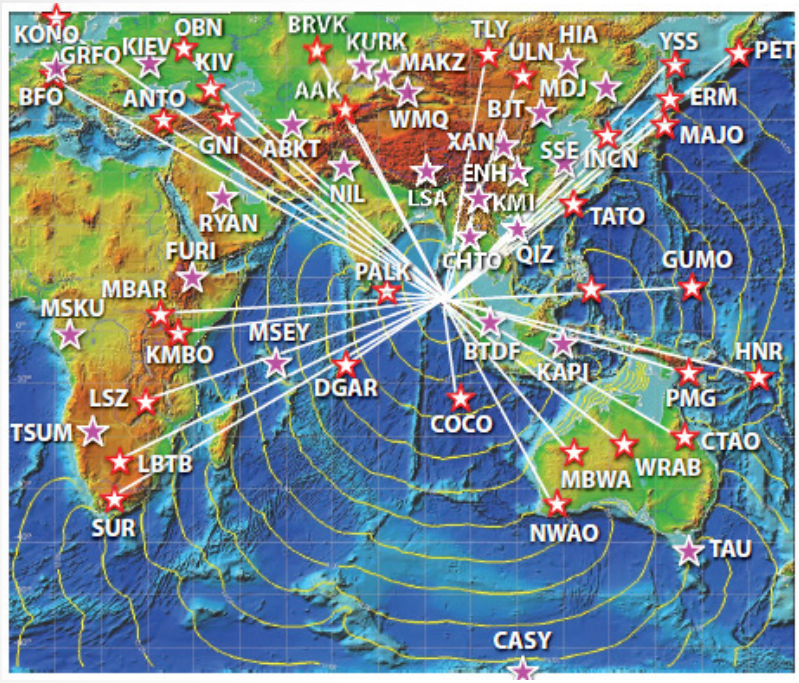
Slip Distribution Images for 2011 M9.0 Tohoku-Oki Earthquake

Global Earthquake Monitoring 2008-2016



Large earthquakes (circles) recorded by the GSN stations
(black – magnitude 5-5.9; red-magnitude 6.0 – 6.9; yellow magnitude 7+
Triangles are the GSN stations

Other Monitoring Applications

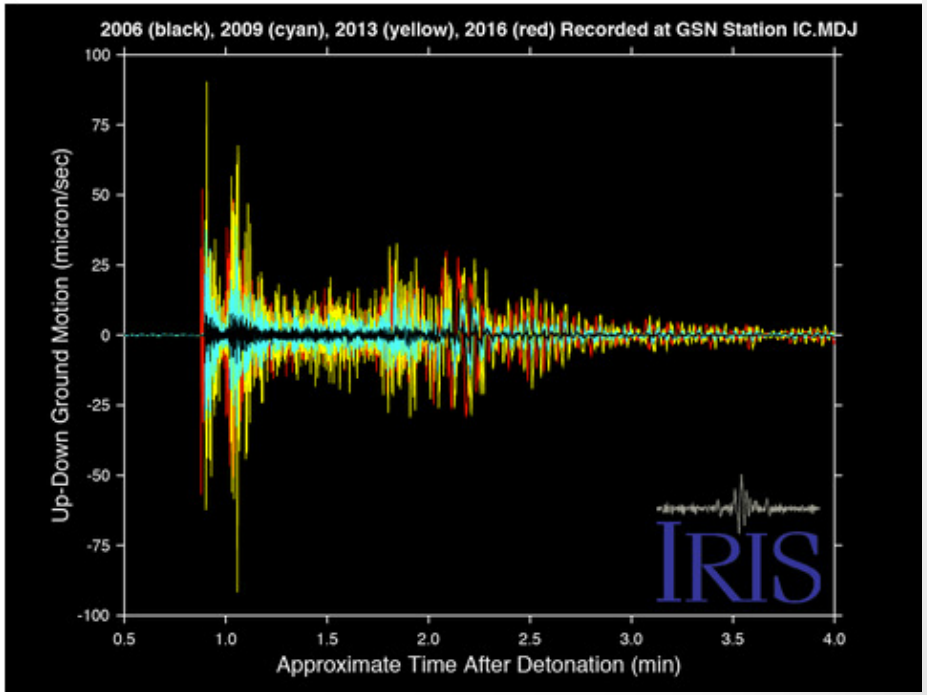


GSN stations used in real-time Tsunami Warning for the Magnitude 9.1 Sumatra-Andaman Earthquake.

Tsunami warning ~100 GSN stations are used for real-time analyses by the NTWC; coverage in oceans and international areas is key – sparse coverage by other networks

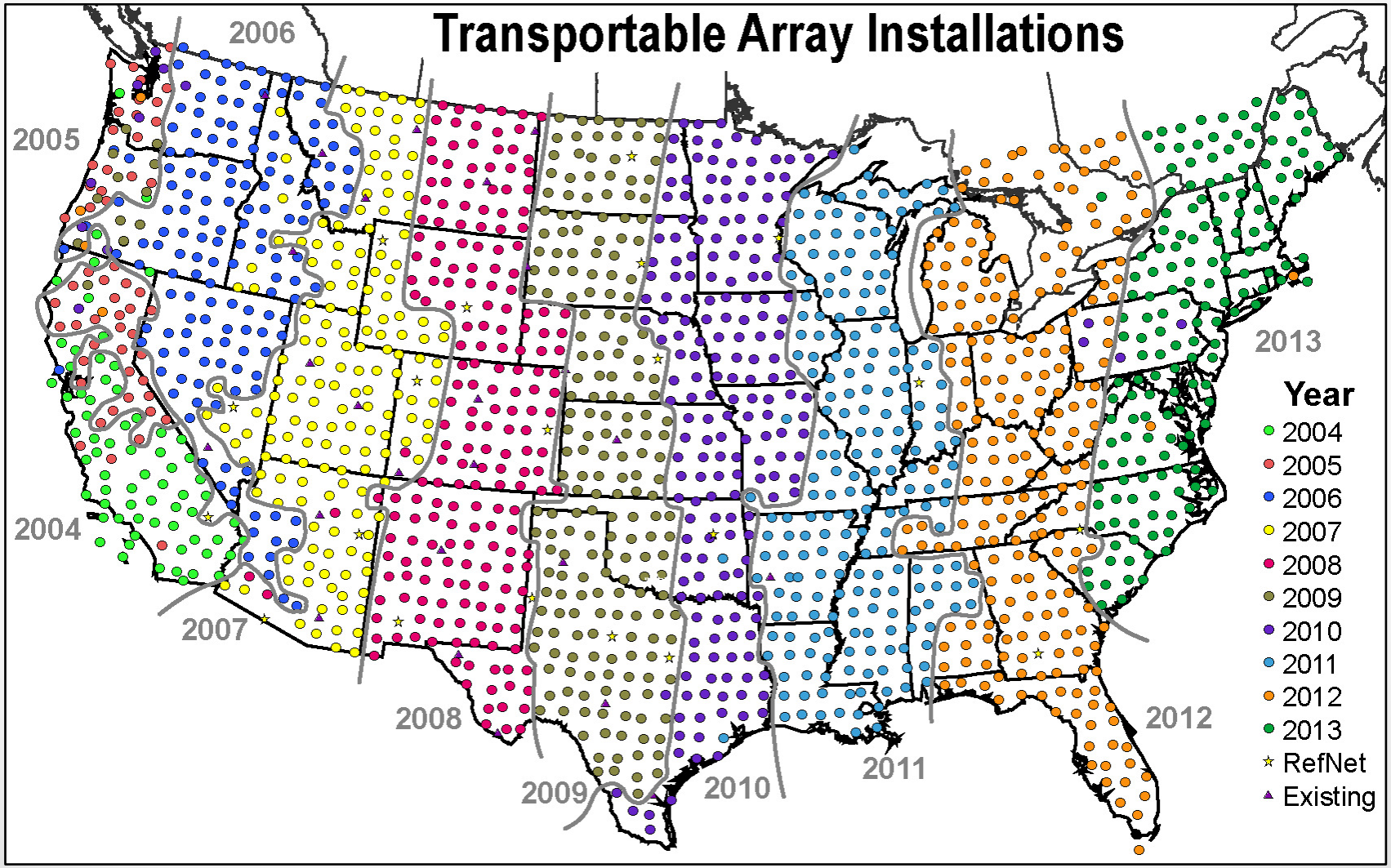
Verification seismology (CTBTO)

- ~50 auxiliary seismic stations are contributed by GSN to nuclear explosion monitoring

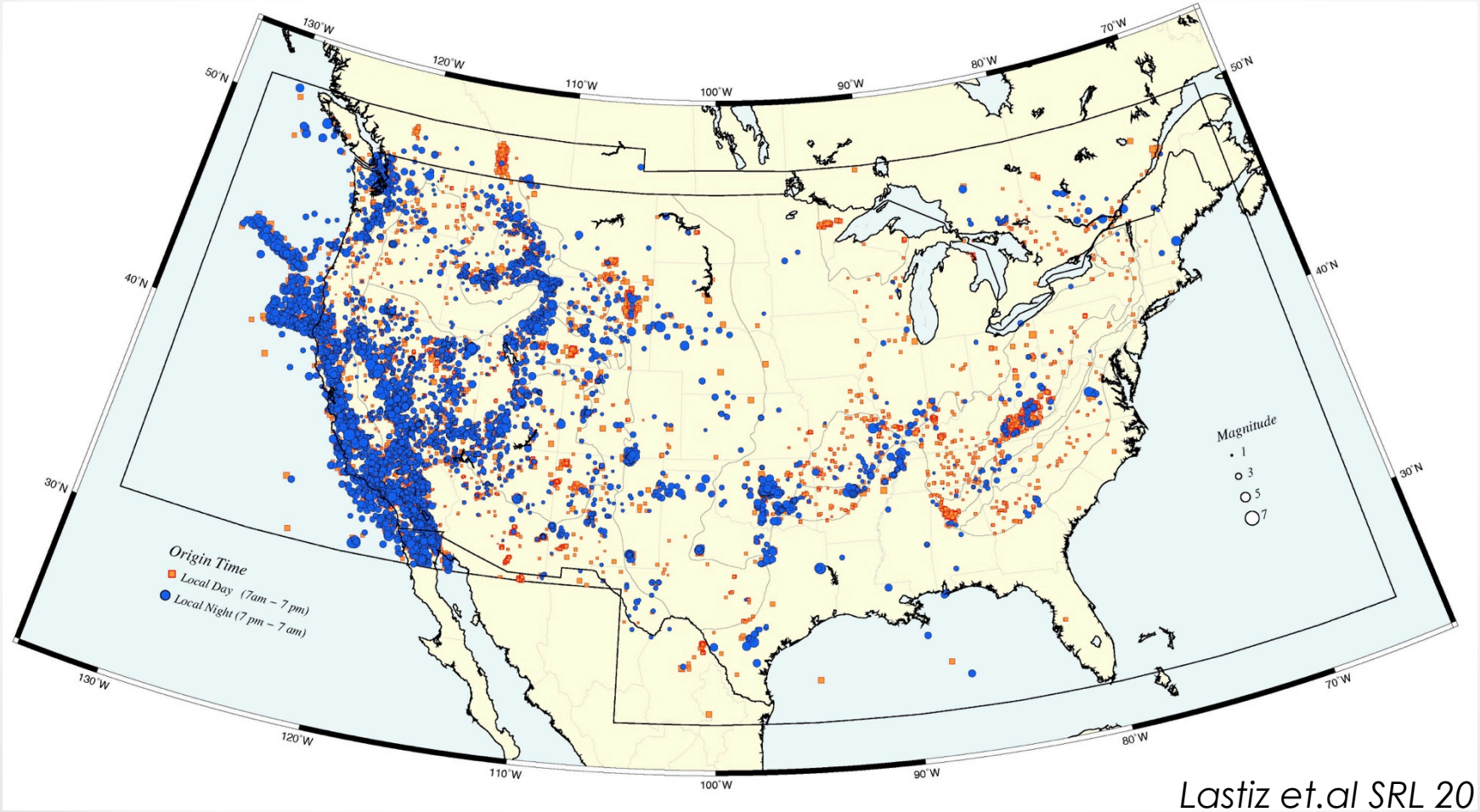


Seismograms of Korean nuclear explosions recorded on GSN station MDJ

Transportable Array (TA) - 10 year Experiment



US Earthquakes Recorded by TA

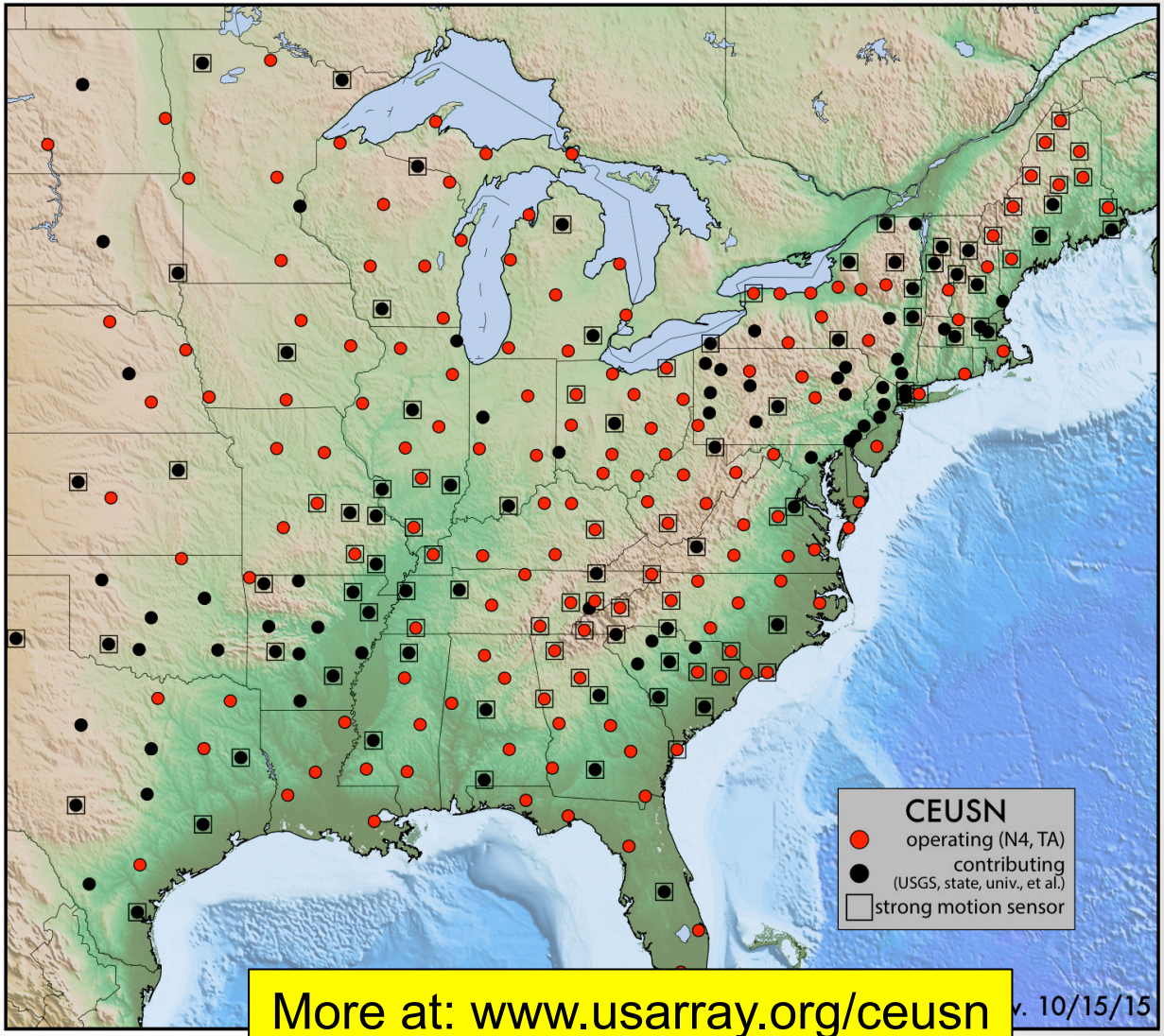


Lastiz et.al SRL 2014

April 2004 to November 2013

Central and Eastern US Network (CEUSN)

- Left 158 TA seismic stations for:
  - Research
  - Hazards assessment
  - Critical facilities
- Multi-agency collaboration
  - NSF
  - USGS
  - US NRC
  - DOE
- "Good government"
  - A unique opportunity to address multiple missions / needs



Seismological Data as a National Asset

- A long-term, continuous archive that contributes to Fundamental and Innovative Research on how the Earth works, e.g. subduction zones, internal structure
- Provides the Framework for Understanding the Processes that cause Earthquakes.
- Used for monitoring the Location, Magnitude and Distribution of Earthquakes on local, regional and global scales
- Used for Tsunami Warning (NOAA) and Monitoring for Nuclear Explosions (CTBTO)
- Unexpected Applications (e.g. mine collapses, "ice quakes" associated with glacier movements, rock falls, episodic tremor and slip (ETS))

Thank you!

Founded in 1984 with support from the National Science Foundation, IRIS is a Consortium of more than 100 universities dedicated to the operation of scientific facilities and provision of services for the acquisition, management and distribution of seismological data. IRIS programs contribute to scholarly research, education, earthquake hazard mitigation, tsunami warning, and to the monitoring of underground nuclear tests. IRIS is a 501 (c) (3) nonprofit organization incorporated in the state of Delaware with its headquarters in Washington, DC.



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